Influence of Attitude and Expectation on Moods and Symptoms During Cold Weather Military Training

RICHARD F. JOHNSON, M.A., Ph.D., LAURENCE G. BRANCH, M.A., Ph.D., and DONNA J. MCMENEMY, B.S.

JOHNSON RF, BRANCH LG, MCMENEMY DJ. *Influence of attitude and expectation on moods and symptoms during cold weather military training.* Aviat. Space Environ. Med. 1989; 60:1157–62.

The present study examined the influence of the following: 1) air temperature, 2) day into training, 3) self rating of life stress, 4) rating of relative warmth in cold weather, and 5) expectation for liking cold weather training, on 59 soldiers' self-reports of illness and mood during 3 days of training in the cold (−18° to 0°C range). Mood was assessed on six domains of the Profile of *Mood States rating scale, and symptoms of illness* were assessed on 5 domains of the Environmental Symptoms Questionnaire. Multiple regression analyses showed that: 1) the more soldiers expected to dislike the cold weather training, the more tense, depressed, angry, fatigued, and physically uncomfortable they were during training; 2) the more stress they perceived in their everyday lives, the more fatigued, confused, and physically uncomfortable they were during training; 3) as days into training increased the more fatigued and physically uncomfortable they became; and 4) due to appropriate clothing and training, ambient temperature was found to have no significant influence on the soldiers' moods and symptoms.

COLD-RELATED INJURIES during cold weather combat are common (5). However, the frequency of cold-related injuries during cold weather military training is low, especially when compared to the frequency of most other injuries (e.g., orthopedic injury and acute trauma) (7,10). This low rate during training may be due to the researcher's focus on reports to sick call at medical treatment facilities and inattention to unreported symptoms. Symptoms may go unreported either because the disorder is treated in the field or the individual fails to report them to anyone. Most prior research (e.g., 7,10) has focused on large populations (thousands of soldiers) making it difficult for research teams to canvass individuals in order to document "unreported" injuries. Recently, the U.S. Army Research Institute of Environmental Medicine has followed smaller groups of soldiers through military training during cold weather. The objective has been to measure systematically the nature and frequency of injuries and illnesses which occur during training (whether reported to the regular medical treatment facility or not) and, concurrently, to assess the psychological moods of the participants. The goal is to determine if illness, psychological mood, or both are systematically related to cold weather conditions, preexisting subjective factors, or both.

Cold-related injury may be defined as tissue trauma produced by exposure to cold temperature. Tissue trauma typically includes the freezing type (frostbite—superficial or deep) and the non-freezing types (chilblains, trench foot, immersion foot, and hypothermia) (2). Among the factors that increase susceptibility of an individual to cold-related injuries are: age (the very young and the very old are more vulnerable), fatigue, inadequate nutrition, inexperience with cold temperatures, previous cold injuries, activity level (both excessive and too little activity predispose one to injury), substances and medications which influence circulation and/or have vascular effects, improper clothing, weather conditions, and psychosocial factors. Race is a factor which historically has been reported to influence susceptibility, specifically Blacks being more vulnerable than Caucasians, but this issue remains unsettled (4).

The above factors have been studied extensively, and the scientific findings have been incorporated into official military guidance for prevention and management of cold injury (1–3).

From the U.S. Army Research Institute of Environmental Medicine, Natick, MA.

This manuscript was received for review in August 1988. The revised manuscript was accepted for publication in April 1989.

Address reprint requests to: Richard F. Johnson, Ph.D., who is a research psychologist with the Health and Performance Division, U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760-5007.

The majority of these factors, such as the soldier's age or whether or not the soldier is receiving medication, are relatively easy to measure. However, the psychosocial factors including attitudes, motivations, and expectations are more difficult to measure and hence to quantify in terms of their influence upon the soldier's susceptibility to the cold.

The present study was designed to clarify the influence of psychosocial factors on the soldier's moods and subjective reports of medical symptoms during cold weather operations. The goal is to determine if subjective symptoms, psychological mood, or both are systematically related to preexisting psychosocial factors, cold weather conditions, days into training, or all three. Specifically, the present investigation seeks to clarify the relative influences of: a) ambient temperature (−18°C to 0°C), b) number of days into outdoor training (1–3 d), and c) three preexisting subjective judgments (self-perception of current stress level, self-perception of relative warmth in cold weather, and self-expectations of like or dislike for an upcoming 3-d outdoor field training exercise (FTX)) on psychological mood and subjective report of medical symptoms.

METHODS

Subjects

The subject population consisted of 107 male volunteers participating in 8 d of winter training at the Army National Guard Mountain Warfare School in northern Vermont. The subjects were active duty and reserve personnel representing the Army National Guard, the Army, the Navy, and the Marine Corps. Training was conducted during two separate 8-d phases; of the 107 male soldiers, 52 participated during Phase I and 55 participated during Phase II. On a daily basis, the subjects completed paper-and-pencil subjective rating scales (these rating scales are described below). Eight of the 107 soldiers were non-Caucasian and were excluded from the study because some literature suggests racial differences in susceptibility to cold-related injuries (1,5) and they were too few to analyze separately. Of the remaining 99 soldiers, 59 (60%) had no missing data on any of the rating scale administrations. These 59 soldiers are the subject of the data analysis.

With respect to personal background, a comparison of the 59 subjects having no missing information with the 40 subjects having some missing information revealed no statistically significant differences between the two groups. The 59 soldiers in the data analysis had a mean age of 30 years, a mean height of 177.8 cm (5 ft 10 in.), and a mean weight of 78.2 kg (172 lbs). More than half (52%) were currently married, but many (36%) had never married; nearly half (48%) did not have formal education beyond high school. Some used tobacco products (29% current smokers and 14% current chewers). The participants were in the service an average of 9 years and were predominantly in the ranks of E4-E6 (42%); 19% were officers.

Measures

On the first day of training, each participant made three subjective self-ratings:

(a) *Subjective stress:* "Indicate the current amount of stress in your life: 1 = no stress, 2 = occasional stress, 3 = frequent stress, and 4 = constant stress;"

(b) *Relative warmth:* "Compared to others around you, in a cool or a cold environment, how do you generally feel: 1 = colder than others, 2 = about the same as others, and 3 = warmer than others;" and

(c) *Expectation for liking the FTX:* "Rate how much you think you are going to like living in the field during this upcoming exercise: 1 = I will like it very much, 2 = I will like it somewhat, 3 = I will neither like it nor dislike it, 4 = I will dislike it somewhat, and 5 = I will dislike it very much."

Most reported occasional stress, felt about the same as others when in the cold, and expected to like the upcoming cold weather training exercise (see Table I).

Profile of Mood States (POMS): This rating scale (8) was completed twice a day (morning and evening) by the participants, each time providing subjective ratings of feelings experienced during the previous 12 h. The POMS is a pencil and paper rating scale of 65 items assessing 6 mood states: tension, depression, anger, vigor, fatigue, and confusion (8).

Environmental Symptoms Questionnaire (ESQ): The ESQ rating scale (6,9) was also administered twice

TABLE I. SELF-REPORTED SUBJECTIVE JUDGMENTS OF STUDY SAMPLE (N = 59).

Subjective Judgment	Percent Subjects Responding				
Current Amount of Stress in Your Life:	None	Occasional	Frequent	Constant	
	5.1%	57.6%	28.8%	8.5%	
Relative Warmth During Cold Weather:	Colder than Others	About Same as Others	Warmer than Others		
	15.3%	54.2%	30.5%		
Expectation for Liking Outdoor Training (FTX):	Like Very Much	Like Somewhat	Neither Like Nor Dislike	Dislike Somewhat	Dislike Very Much
	40.7%	35.6%	13.6%	8.5%	1.7%

daily (morning and evening), each time providing subjective ratings of symptoms experienced during the previous 12 h. The ESQ is a pencil and paper rating scale of 68 items developed at the U.S. Army Research Institute of Environmental Medicine which obtains reports of frequency of complaints of medical symptoms such as feeling chilly, feeling weak, feeling cold hands, etc. The ESQ was re-worded for the past tense, and subjects were instructed to score each item according to "how you have been feeling during the past day/night." For this analysis, selected items of the ESQ were grouped into additive scales for each of five domains: tiredness, muscle discomfort, cardiopulmonary discomfort, feelings of well-being, and cold discomfort. These five domains are presented in Table II along with the numbers of the items in the ESQ which were added together to comprise each domain, and Cronbach's alpha statistic of reliability.

Weather conditions, including dry bulb temperature, were recorded continuously; mean daytime temperature was used in subsequent analyses.

Context

During training, the soldiers learned military tactics for operations in mountainous terrain. Instruction took place both in indoor classrooms and outdoor settings. Near the end of training, 3 days and 2 nights were devoted to an outdoor FTX. During the days prior to the FTX, the participants received lectures on strategies for preventing cold-related injuries and discomfort. In addition, appropriate cold weather clothing and equipment were supplied to each participant. Individual clothing included arctic boots, mittens, parka, cold weather trousers, and layers of shirts and undergarments.

The average daytime temperature during the three days of outdoor training was always above −18°C (0°F) and below 0°C (32°F). The actual average daytime temperatures during the two phases of FTX training were: −16.3°, −15.1°, −13.9°, −12.9°, −1.8°, and −0.9°C.

The focus of the present analysis is the three subjective judgments made prior to the FTX, the average daily temperature during the FTX, the number of days into the FTX, the self-reported moods (POMS) during the FTX, and the self-reported symptoms (ESQ) during the FTX. Only the soldiers' POMS and ESQ scores at the end of each day were used in the analysis. Concern with the utility of the nighttime scores because of the variability of temperatures within and between tents necessitated their exclusion from the analysis.

Analytic Techniques

Ordinary least squares and forward stepwise multiple regression analyses were used to analyze the data. Three self-reports of moods (POMS) and three self-reports of symptoms (ESQ) (both reflecting the 3 d of outdoor training) comprise the dependent variables used in the 11 regression analyses (1 analysis for each of the 6 domains of the POMS and 1 for each of the 5 domains of the ESQ). The resulting regression equations are based on 177 records: 59 soldiers providing ratings at the end of each of the 3 FTX days. Each of the 11 dependent variables is continuous. The 5 independent variables for each regression analysis are ambient temperature, the number of days into the outdoor training, and the 3 subjective judgments made prior to the FTX. Collinearity among the 5 independent variables was not problematic; none of the bivariate correlations among them exceeded 0.6. The regression model does not require adaptations for the fact that the 3 subjective judgments were repeated measures for the 59 soldiers comprising the 177 records. The last step in the stepwise model and the least squares model produced comparable results; hence, only the ordinary least squares model is presented.

TABLE II. THE 5 ENVIRONMENTAL SYMPTOMS QUESTIONNAIRE (ESQ) DOMAINS.

ESQ Domain	Items Comprising Domain	Cronbach's Alpha
1. Cold discomfort	My hands were cold	.90
	My feet were cold	
	I felt chilly	
	I was shivering	
	Parts of my body felt numb	
2. Muscle discomfort	I had a muscle cramp	.80
	My muscles felt tight or stiff	
	My legs or feet ached	
	My hands, arms, or shoulders ached	
	My back ached	
3. Cardiopulmonary discomfort	I was short of breath	.76
	It was hard to breathe	
	It hurt to breathe	
	My heart was beating fast	
	My heart was pounding	
	I had a chest pain	
	I had chest pressure	
4. Tiredness	I felt weak	.70
	I felt tired	
	I felt sleepy	
5. Feelings of well-being	I felt good	.86
	I felt alert	
	I felt wide awake	

RESULTS

Tables III and IV summarize the results of the multiple regression analyses on self-reported psychological mood (POMS) and self-reported symptoms (ESQ).

Determinants of Mood

Concerning the POMS domains of mood labeled tension, depression, and anger, only one variable achieved statistical significance as a predictor: the individual's expectation of like or dislike of the outdoor training exercise (Table III). Those whose expectation was dislike of the upcoming exercise reported significantly more tension, significantly more depression, and significantly more anger than those whose predisposition was to like the exercise.

The domains of vigor and confusion also were each predicted by one significant variable, self-reported stress. Those reporting lower levels of current stress subsequently reported more vigor during the training, while those initially reporting higher levels of current stress subsequently reported more confusion during the training.

The sixth psychological mood, fatigue, was significantly influenced by three predictors. More fatigue was reported as the training exercise progressed. Those who initially expected to dislike the exercise reported more fatigue. In addition, those who reported more stress in their current lives reported more fatigue during the training.

Determinants of Symptoms

The regression analyses on the domains of symptoms from the ESQ are presented in Table IV.

The variables significantly related to the ESQ tiredness domain are identical to those significantly related to POMS fatigue: the number of days into training, the initial expectations of disliking the outdoor training, and the more reported stress in current life were each significant independent predictors of ESQ tiredness. Although the individual questions comprising the ESQ tiredness domain emphasize sleepiness and tiredness rather than physical fatigue due to exertion, as does the POMS fatigue domain, it is likely that ESQ tiredness and POMS fatigue are measuring the same subjective experience.

The ESQ domain of muscle discomfort (e.g., aches and pains) was significantly predicted by an expectation of disliking the outdoor training, a judgment of feeling colder than others when in a cold environment, and by the number of days into the training.

Lower levels of self-assessed stress significantly influenced expressions of feelings of general well-being such as feeling good or feeling alert.

Expressions of cold discomfort such as cold hands, cold feet, being chilly, shivering, or numbness were not significantly influenced by any of the five factors in the model.

Cardiopulmonary discomforts such as chest pain and breathing hard were influenced only by the number of days into the training: the more days into the FTX the more cardiopulmonary discomfort.

DISCUSSION

In the context of a 3-d outdoor winter training exercise of moderate activity level, with average daytime ambient temperatures below freezing but above −18°C (0°F), with appropriate winter field clothing and with instruction on the prevention of cold-related injuries, it was possible to develop multiple regression models to determine the independent influence of the five predictor variables: temperature, days into training, and three subjective judgments (current stress level, rating of warmth relative to others in cold environments, and expectation of liking/disliking the outdoor training). Although some of the R^2s were small, others were high for social science research; R^2 for POMS-fatigue indicated that 24.1% of the variance was taken into account while the R^2s for ESQ-tiredness and ESQ-muscle discomfort indicated that 20.2% and 18.4% of the variance were taken into account, respectively.

Ambient temperature was not a significant independent predictor of any of the 11 moods or symptoms.

TABLE III. ORDINARY LEAST SQUARES REGRESSION ANALYSIS OF SIX PSYCHOLOGICAL MOODS FROM THE PROFILE OF MOOD STATES (POMS) RATING SCALE.

	Psychological Mood[a]											
	Tension		Depression		Anger		Vigor		Fatigue		Confusion	
Predictor Variable	Beta	p[b]	Beta	p[b]	Beta	p[b]	Beta	p[b]	Beta	p[b]	Beta	p[b]
Ambient Temperature	0.1517		0.0704		0.0802		0.0578		0.1241		0.0106	
Days into FTX	0.1303		0.1074		0.1517		−0.0837		0.3414	0.00	0.0024	
Subjective Judgments												
Stress[c]	0.0462		0.0923		0.1072		−0.1893	0.02	0.1641	0.02	0.2743	0.00
Relative warmth[d]	0.1161		0.1535		0.1726		0.1177		0.0968		0.0241	
Expectation for liking FTX[e]	0.2084	0.02	0.2981	0.00	0.2535	0.01	−0.0153		0.3365	0.00	0.1292	
R^2	0.0642		0.0903		0.0838		0.0613		0.2409		0.0986	

[a] A higher score indicates a stronger mood.
[b] Probability of significance of the association if $p \leq 0.05$.
[c] Self report of current stress in life; a high score indicates more stress.
[d] Self report of feelings of warmth in a cold environment; a low score indicates colder than others, a high score indicates warmer than others.
[e] Self report of expected like for FTX; a low score indicates like for the FTX, a high score indicates dislike.

TABLE IV. ORDINARY LEAST SQUARES REGRESSION ANALYSIS OF FIVE SYMPTOMS FROM THE ENVIRONMENTAL SYMPTOMS QUESTIONNAIRE (ESQ).

Predictor Variable	Environmental Symptom[a]									
	Cold Discomfort		Muscle Discomfort		Cardiopulmonary Discomfort		Tiredness		Feeling of Well-Being	
	Beta	p[b]	Beta	p[b]	Beta	p[b]	Beta	p[b]	Beta	p[b]
Ambient Temperature	−0.0862		−0.0360		0.1632		0.0694		0.0840	
Days into FTX	0.1396		0.2185	0.01	0.2524	0.00	0.2860	0.00	−0.0394	
Subjective Judgments										
Stress[c]	0.0918		0.0769		−0.0885		0.1931	0.01	−0.2069	0.01
Relative warmth[d]	−0.1026		−0.2276	0.01	0.1210		−0.0993		0.0739	
Expectation for liking FTX[e]	0.1250		0.1694	0.05	0.1456		0.1862	0.03	−0.0296	
R^2	0.0765		0.1835		0.0665		0.2017		.0532	

[a] A higher score indicates a more intense symptom.
[b] Probability of significance of the association if $p \leq 0.05$.
[c] Self report of current stress in life; a high score indicates more stress.
[d] Self report of feelings of warmth in a cold environment; a low score indicates colder than others, a high score indicates warmer than others.
[e] Self report of expected like for FTX; a low score indicates like for the FTX, a high score indicates dislike.

This was likely due to the fact that the microenvironment of the soldier was relatively stable. That is, even though the air temperature of the surrounding environment was below freezing, the soldier was suitably clothed and thus protected from such an environment. Suitable winter clothing, combined with the vigorous exercise required by the FTX, resulted not in symptoms indicative of a cold soldier, but rather symptoms of a soldier who actually is relatively warm and adapted to his surroundings. In addition, reports of cold-related discomfort were not significantly related to any of the five potential predictor variables. This finding suggests that the clothing, instruction on cold injury prevention, level of activity, and duration of the exercise were effective and appropriate for this range of ambient temperature (−18° to 0°C) regardless of the participants' initial attitudes and expectations. Further research in colder environments (below −18°C), where it is more difficult for the soldier to remain warm, may show a significant influence of ambient temperature on cold-related discomfort.

The number of days into training was significantly related to each of the domains which assess some aspect of physical tiredness (i.e., POMS fatigue, ESQ tiredness, cardiopulmonary discomfort, and muscle discomfort). This suggests that the level of activity required by the outdoor training phase exceeded the participants' level of usual activity, and consequently produced general physical fatigue. In fact, one of the objectives of the outdoor training was to require a level of physical challenge beyond the usual level of the participants. Apparently this objective was met.

The individual's judgment of his own level of current stress was an important predictor of subsequent moods and reactions during outdoor winter training. Those who reported higher stress in their daily lives were found to report more confusion, less vigor, more fatigue, more tiredness, and less feeling of well-being during the subsequent outdoor activities. This pattern of reports during training, all influenced significantly by the level of stress the individual brought to the training, suggests a subgroup of individuals who can be identified in advance as perhaps requiring specialized attention during training exercises such as this one.

The individual's expectation to like or dislike the outdoor training was an important predictor for 6 of the 11 subsequent moods and symptoms. Those expecting to dislike the outdoor training subsequently reported more tension, depression, anger, fatigue, tiredness, and muscle discomfort. This pattern strongly supports the interpretation that expectations and outcomes are intertwined. These individuals might have had accurate self-knowledge based on prior experience to predict accurately their own negative reactions, or they might have "programmed" themselves to have negative reactions and produced self-fulfilling prophecies. It is clear that the individual's expectancy was demonstrated to be a powerful and independent predictor of subsequent moods and symptoms.

There are limits to the generalizability of these findings. First, the findings were produced in the context of a mild winter temperature range: below freezing but above −18°C (0°F). Second, the participants had a full supply of appropriate arctic clothing and state-of-the-art instruction on the prevention of cold-related injuries. Third, the length of outdoor training was only 3 d. Therefore, it is unwarranted to generalize these findings to temperatures below −18°C (0°F), to individuals without appropriate clothing or instruction on the prevention of cold-related injuries, or to longer periods of exposure to the cold outdoors.

CONCLUSIONS

In summary, during a 3-d military training exercise in cold mountainous terrain, it was found that:

(a) the more the soldiers expected to dislike the FTX, as measured prior to the FTX, the more tense, depressed, angry, fatigued, and physically uncomfortable they were when on the FTX;

(b) the more stress the soldiers perceived in their everyday lives outside of the FTX, the more fatigued, confused, and uncomfortable they were when on the FTX;

(c) the longer the soldiers were on the FTX the more fatigued and physically uncomfortable they became; and

(d) ambient temperature (in the −18° to 0°C range) was found to have no significant influence on the soldiers' moods and physical symptoms (probably due to appropriate clothing, training, and activity level).

This study suggests that a subgroup of individuals may be identified in advance of a cold weather FTX who are likely to display symptoms of negative mood (tension, depression, anger, and confusion) and symptoms of poor physical well-being (tiredness and muscle discomfort) when they are on the FTX. These individuals are likely to have more stress in their current everyday lives, are likely to expect that they will dislike being on the particular upcoming FTX, or both.

ACKNOWLEDGMENTS

The authors wish to thank the officers and enlisted personnel of the Army National Guard Mountain Warfare School, Jericho, VT, for letting us observe winter training at the School. By permitting us to administer the POMS and the ESQ at the same time each day, our data collection went smoothly and our data are more rigorous than might otherwise have been the case. Special thanks are extended to MAJ Russell Holden, who spent much personal time assisting in the planning of the study and who insured that we received much of the material support we required to carry out this study. The following individuals rendered invaluable assistance in the collection of the data: SGT Douglas T. Dauphinee, Ms. Shelley R. Strowman, MAJ Earl S. Stein, and CPT Peter Manilla.

The views, opinions, and/or findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other official documentation.

Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

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